

Appendix 10. Resources for Estimating Emissions

Primary emissions data sources are preceded with an asterisk (); all other references are secondary.*

EPA Publications

8. EPA. 2000. *Background Information Document for Proposed Plywood and Composite Wood Products NESHAP*. EPA-453/R-01-004. Research Triangle Park, NC: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards.
<https://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPPT-2012-0018-0364>.
9. * EPA. 2003. *Compilation of Air Pollution Emission Factors. Volume 1: Stationary Point and Area Sources (5th Edition)*. AP-42. Chapter 10, Wood Products Industry;
<https://www3.epa.gov/ttn/chief/ap42/ch10/final/c10s00.pdf>

NCASI Publications

The following list of NCASI publications is available to NCASI members. Contact: National Council for Air and Stream Improvement, Inc. Southern Regional Center; 402 SW 140th Terrace, Newberry, FL 32669; Phone (352) 331-1745.

1. National Council for Air and Stream Improvement, Inc. (NCASI). 1996. *A Small –Scale Kiln Study on Method 25A Measurements of Volatile Organic Compound Emissions from Lumber Drying*. Technical Bulletin No. 718. Research Triangle Park, N.C.: National Council for Air and Stream Improvement, Inc.
2. National Council for Air and Stream Improvement, Inc. (NCASI). 1996. *Laboratory and Limited Field Measurements of VOC Emissions from Wood Residuals*. Technical Bulletin No. 723. Research Triangle Park, N.C.: National Council for Air and Stream Improvement, Inc.
3. * National Council for Air and Stream Improvement, Inc. (NCASI). 1999. *Volatile Organic Compound Emissions from Wood Products Manufacturing Facilities; Part I – Plywood*. Technical Bulletin No. 768. Research Triangle Park, N.C.: National Council for Air and Stream Improvement, Inc.
4. * National Council for Air and Stream Improvement, Inc. (NCASI). 1999. *Volatile Organic Compound Emissions from Wood Products Manufacturing Facilities; Part II – Engineered Wood Products*. Technical Bulletin No. 769. Research Triangle Park, N.C.: National Council for Air and Stream Improvement, Inc.
5. * National Council for Air and Stream Improvement, Inc. (NCASI). 1999. *Volatile Organic Compound Emissions from Wood Products Manufacturing Facilities; Part III – Medium Density Fiberboard*. Technical Bulletin No. 770. Research Triangle Park, N.C.: National Council for Air and Stream Improvement, Inc.
6. * National Council for Air and Stream Improvement, Inc. (NCASI). 1999. *Volatile Organic Compound Emissions from Wood Products Manufacturing Facilities; Part IV – Particleboard*. Technical Bulletin No. 771. Research Triangle Park, N.C.: National Council for Air and Stream Improvement, Inc.
7. * National Council for Air and Stream Improvement, Inc. (NCASI). 1999. *Volatile Organic Compound Emissions from Wood Products Manufacturing Facilities; Part V – Oriented*

- Strandboard*. Technical Bulletin No. 772. Research Triangle Park, N.C.: National Council for Air and Stream Improvement, Inc.
8. * National Council for Air and Stream Improvement, Inc. (NCASI). 1999. *Volatile Organic Compound Emissions from Wood Products Manufacturing Facilities; Part VI – Hardboard and Fiberboard*. Technical Bulletin No. 773. Research Triangle Park, N.C.: National Council for Air and Stream Improvement, Inc.
 9. National Council for Air and Stream Improvement, Inc. (NCASI). 2002. *A Comparative Study of VOC Emissions from Small-Scale and Full-Scale Lumber Kilns Drying Southern Pine*. Technical Bulletin No. 845. Research Triangle Park, N.C.: National Council for Air and Stream Improvement, Inc.
 10. National Council for Air and Stream Improvement, Inc. (NCASI). 2002. *Review of EPA Regulations and Guidance Related to VOC Emissions*. Special Report No. 02-04. Research Triangle Park, N.C.: National Council for Air and Stream Improvement, Inc.
 11. National Council for Air and Stream Improvement, Inc. (NCASI). 2003. *An Evaluation of Control Efficiency at Different Combustion chamber Temperatures for Regenerative Thermal Oxidizers Installed on Panel Plant Wood Furnish Dryers*. Technical Bulletin No. 865. Research Triangle Park, N.C.: National Council for Air and Stream Improvement, Inc.
 12. National Council for Air and Stream Improvement, Inc. (NCASI). 2003. *An Evaluation of Credit-Generating Emission Sources for Use in the Emissions Averaging Compliance Option Under the Wood Products NESHAP*. Technical Bulletin No. 869. Research Triangle Park, N.C.: National Council for Air and Stream Improvement, Inc.
 13. National Council for Air and Stream Improvement, Inc. (NCASI). 2004. *Canadian Environmental Protection Act Aldehydes and the Forest Products Industry*. Technical Bulletin No. 874. Research Triangle Park, N.C.: National Council for Air and Stream Improvement, Inc.
 14. National Council for Air and Stream Improvement, Inc. (NCASI). 2008. *Wood Products Air Quality Technical Information Document*. Special Report No. 08-01. Research Triangle Park, N.C.: National Council for Air and Stream Improvement, Inc.
 15. National Council for Air and Stream Improvement, Inc. (NCASI). 2011. *Characterization, Measurement and Reporting of Volatile Organic Compounds Emitted from Southern Pine Wood Products Sources*. Technical Bulletin No. 991. Research Triangle Park, N.C.: National Council for Air and Stream Improvement, Inc.
 16. * National Council for Air and Stream Improvement, Inc. (NCASI). 2013. *A Comprehensive Compilation and Review of Wood-Fired Boiler Emissions*. Technical Bulletin No. 1013. Research Triangle Park, N.C.: National Council for Air and Stream Improvement, Inc.
 17. National Council for Air and Stream Improvement, Inc. (NCASI). 2008 and 2014. *Lumber Kiln Emissions Literature and Kiln Emission Factors White Paper; An Update and Addendum To The 2008 Lumber Kiln Emissions White Paper*. Research Triangle Park, N.C.: National Council for Air and Stream Improvement, Inc.
 18. * National Council for Air and Stream Improvement, Inc. (NCASI). 2013. *Air Emissions Database - Wood Products*. <http://www.ncasi.org/Programs/Air-Quality/Resources/Air-Emissions-Database---Wood-Products/Index.aspx>. Research Triangle Park, N.C.: National Council for Air and Stream Improvement, Inc.
 19. National Council for Air and Stream Improvement, Inc. (NCASI). 2015. *Air Emissions Databases - Pulp and Paper*. <http://www.ncasi.org/Programs/Air-Quality/Resources/Air-Emissions->

[Database---Pulp-and-Paper/Index.aspx](#). Research Triangle Park, N.C.: National Council for Air and Stream Improvement, Inc.

Peer Reviewed Scientific Journal References

20. Dahlen, J., Prewitt, L., Shmulsky, R., and Jones, D. 2011. Hazardous air pollutants and volatile organic compounds emitted during kiln drying of southern pine lumber to interior and export moisture specifications. *Forest Prod. J.* 61(3):229-234.
21. McDonald, A.G., Gifford, J.S., Steward, D., Dare, P.H., Riley, S., and Simpson, I. 2004. Air emissions from timber drying: High temperature drying and re-drying of CCA treated timber. *Holz Roh-Werkst.* 62:291-302.
22. Milota, M., and Mosher, P. 2006. Emissions from western hemlock lumber during drying. *Forest Prod. J.* 56(5):66-70.
23. Milota, M.R. 2003. HAP and VOC emissions from white fir lumber dried at high and conventional temperatures. *Forest Prod. J.* 53(3):60-64
24. Otwell, L.P., Hittmeir, M.E., Hooda, U., Yan, H., Su, W., and Banerjee, S. 2000. *HAPs released from wood drying. Environ. Sci. Technol.* 34: 2280-2283.
25. Su, W., Yan, H., Banerjee, S., Otwell, L.P., and Hittmeier, M. 1999. Field-proven strategies for reducing volatile organic carbons from hardwood drying. *Environ. Sci. Technol.* 33:1056-1059.

Dioxin/Furan Congeners and Toxic Equivalency Factors

Should emissions of dioxin/furan emissions be reported, they will need to be speciated into individual congeners and converted to 2,3,7,8-TCDD toxic equivalency (TEQ) for the EPA's risk analyses. The congeners of interest are listed in Table 10-1 below, along with the toxic equivalency factor (TEF) used to express the mass of each congener in terms of its 2,3,7,8-TCDD TEQ. Multiple the emissions of each congener by the TEF to obtain emissions in terms of TEQ.

Table 10-1. Dioxin/Furan Congeners and Associated Toxic Equivalency Factors

Pollutant code	Pollutant description	TEF ^a
1746016	2,3,7,8-Tetrachlorobenzo-p-Dioxin	1
40321764	1,2,3,7,8-Pentachlorodibenzo-p-Dioxin	1
39227286	1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin	0.1
57653857	1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin	0.1
19408743	1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin	0.1
35822469	1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin	0.01
3268879	Octachlorodibenzo-p-Dioxin	0.0003
51207319	2,3,7,8-Tetrachlorodibenzofuran	0.1
57117416	1,2,3,7,8-Pentachlorodibenzofuran	0.03
57117314	2,3,4,7,8-Pentachlorodibenzofuran	0.3
70648269	1,2,3,4,7,8-Hexachlorodibenzofuran	0.1
57117449	1,2,3,6,7,8-Hexachlorodibenzofuran	0.1
72918219	1,2,3,7,8,9-Hexachlorodibenzofuran	0.1
60851345	2,3,4,6,7,8-Hexachlorodibenzofuran	0.1
67562394	1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.01
55673897	1,2,3,4,7,8,9-Heptachlorodibenzofuran	0.01
39001020	Octachlorodibenzofuran	0.0003

^a TEF values for 2,3,7,8-tetrachlorodibenzo-p-dioxin TEQ, published in 2005 by the World Health Organization, and adopted by the EPA in 2008 for risk assessments.¹⁴

¹⁴ U.S. Environmental Protection Agency. *Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds*. Publication No. EPA/100/R-10/005. Available at: <http://www.epa.gov/raf/files/tefs-for-dioxin-epa-00-r-10-005-final.pdf>. December 2010. (EPA 2010)